



NASA Habitation Work at KSC

UCF Space Day

March 13, 2013

Tracy Gill/NASA-KSC

Dr. Eirik Holbert/NASA-KSC

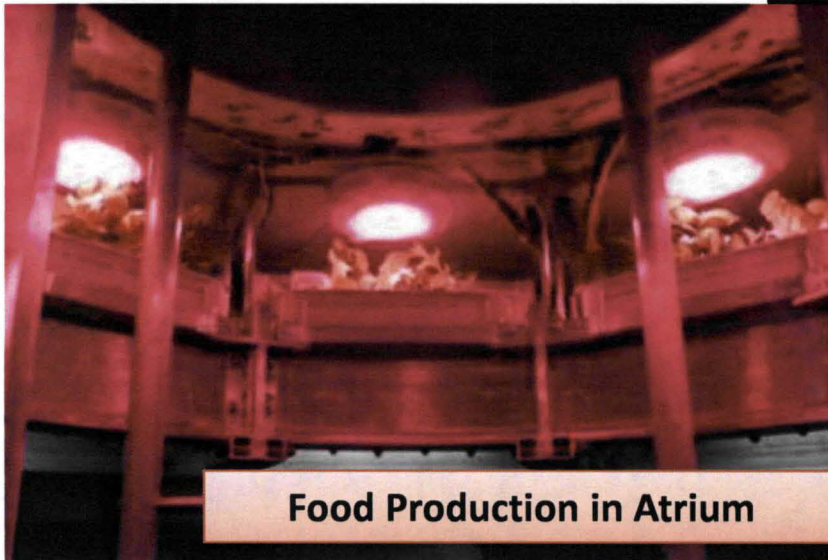


Deep Space Habitat Concept Demonstrators

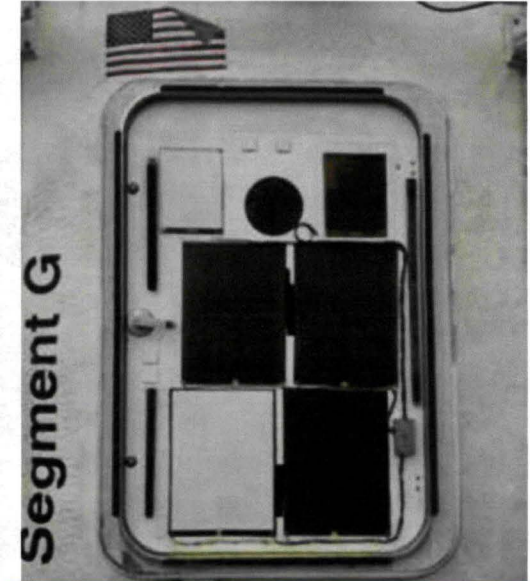
- Deep Space Habitat concepts mature under Advanced Exploration System Program – Habitat Systems Project
- Current Project web page
 - http://www.nasa.gov/exploration/technology/deep_space_habitat/index.html
- X-Hab Academic Innovation Challenge
 - <http://www.spacegrant.org/xhab/>
- Concept Demonstrators
 - Habitat Demonstration Unit – DSH at JSC (transferred to Human Research Program for human factors studies)
 - ISS-derived DSH under development at MSFC



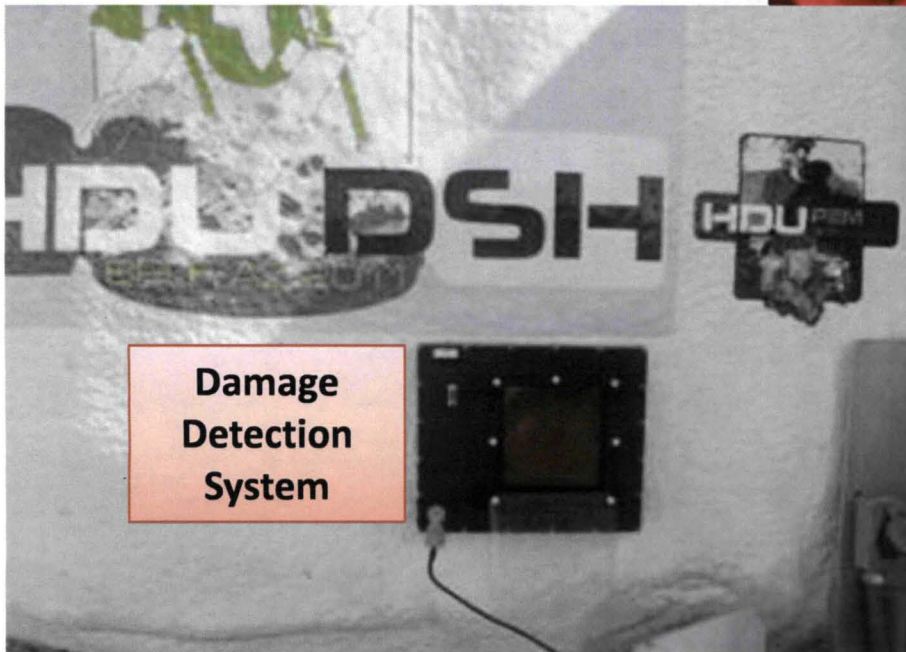
Habitat System Technology Demonstrations



Food Production in Atrium



**Dust Mitigation:
Electrodynamic Dust Shield
& Lotus Coating**



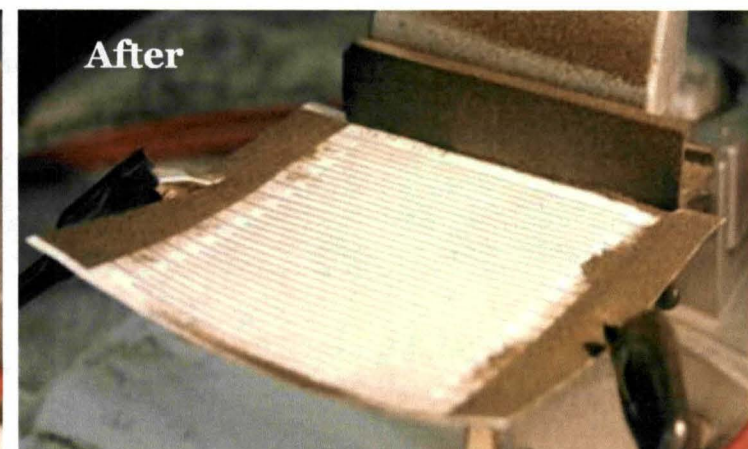
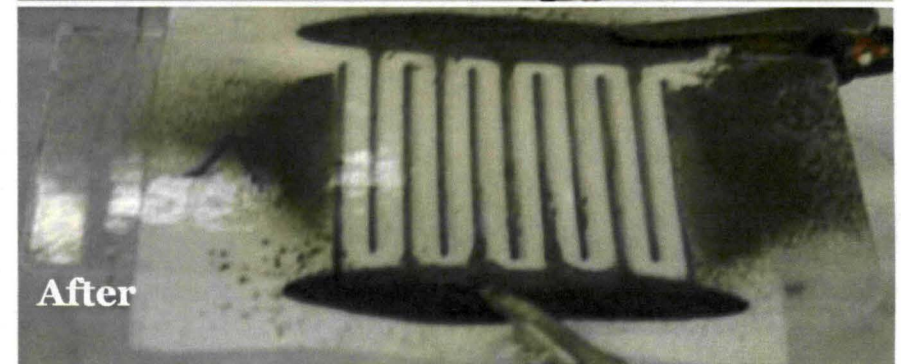
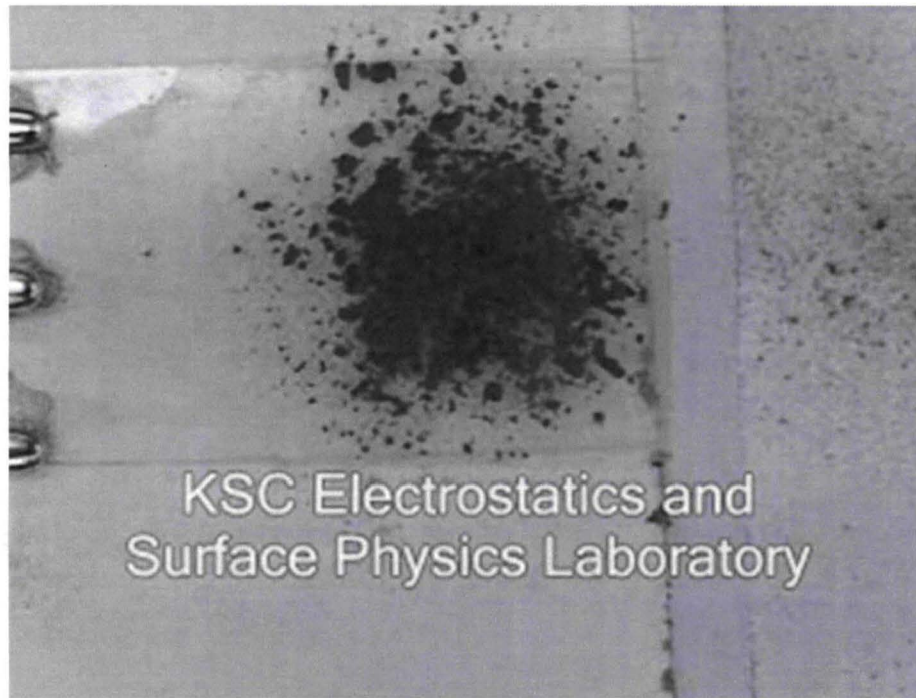
**Damage
Detection
System**



**Cargo Transfer Bag
Radiation Protection
Water Walls**



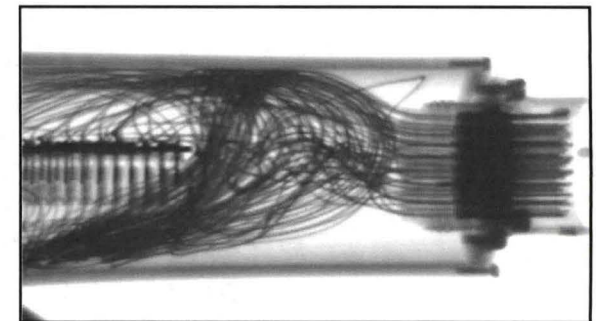
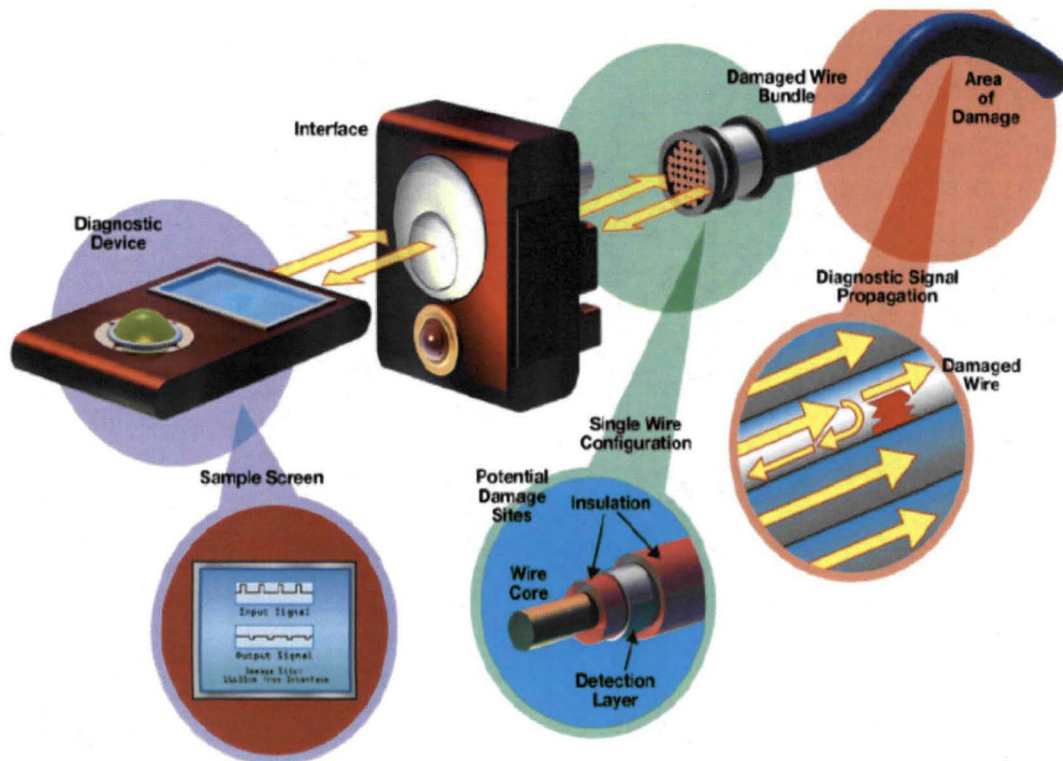
EVA Dust Shields for Space Suits and Habitats





Wire Detection and Monitoring

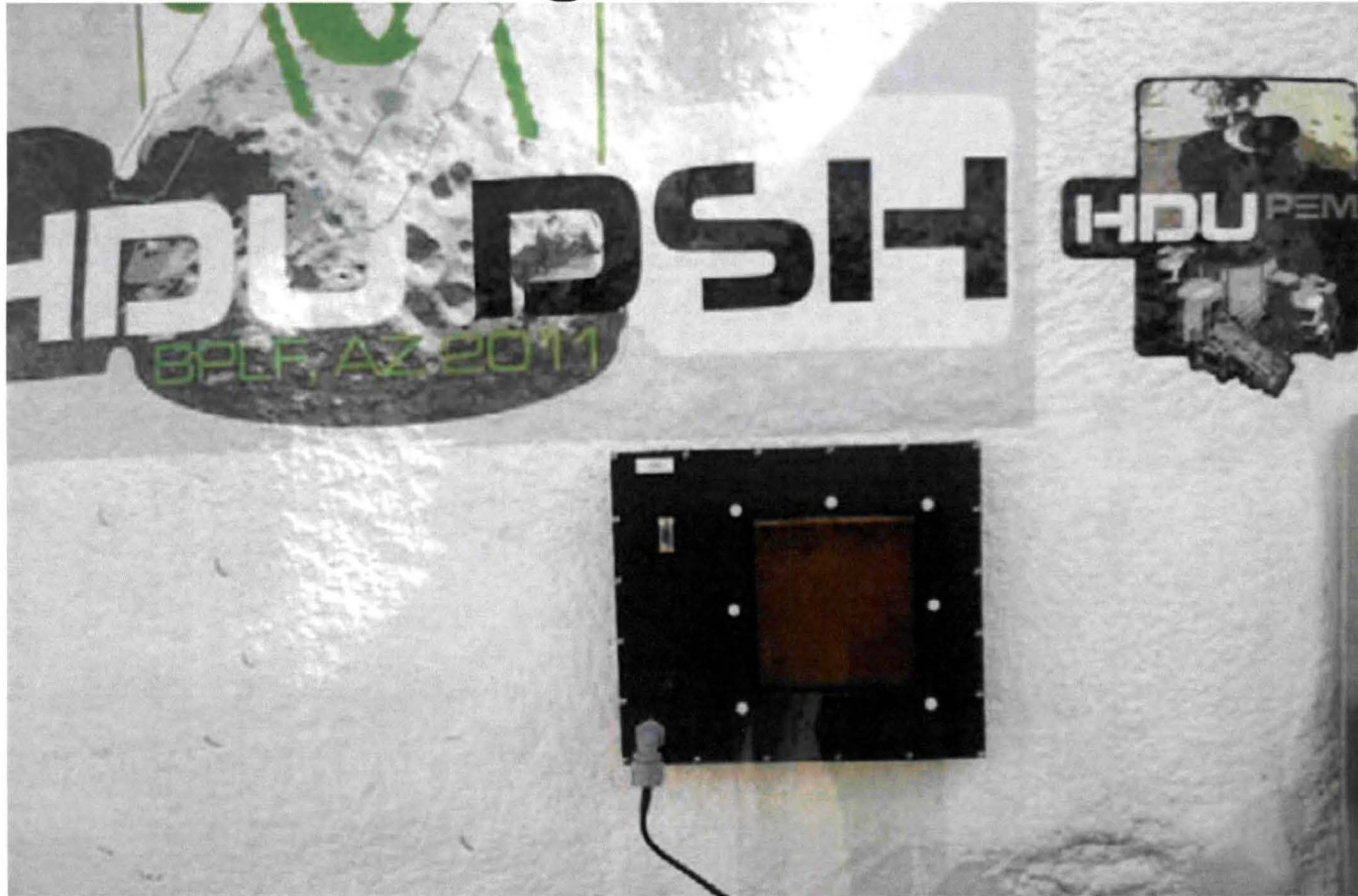
- In-situ wire damage detection system
 - Capable of wire damage detection “on-the-fly”
- Smart Connectors
 - Small, lightweight, ultra reliable
- Integrated vehicle health monitoring (IVHM)
 - System-of-systems level, providing high level of reliability



X-ray image of miniaturized TDR connector



Flat Surface Damage Detection



The Flat Surface Damage Detection system uses a series of two-dimensional detection systems and printed conductive circuitry to demonstrate a detection system for real time damage diagnosis (location and percent damage). This system will provide the ability to monitor the integrity of a composite or inflatable habitat with in situ system health monitoring.



Flat Surface Damage Detection

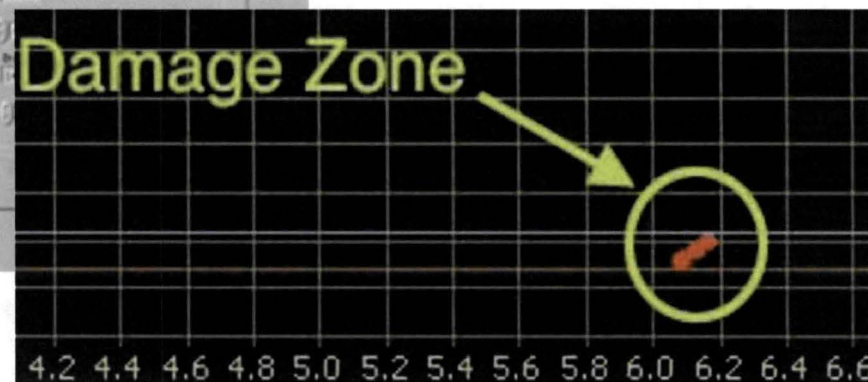
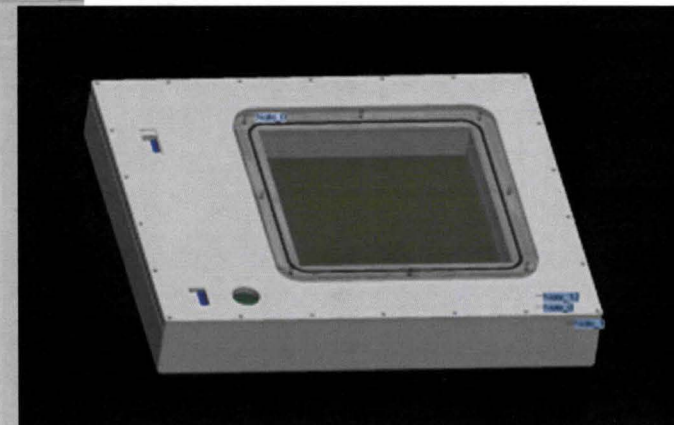
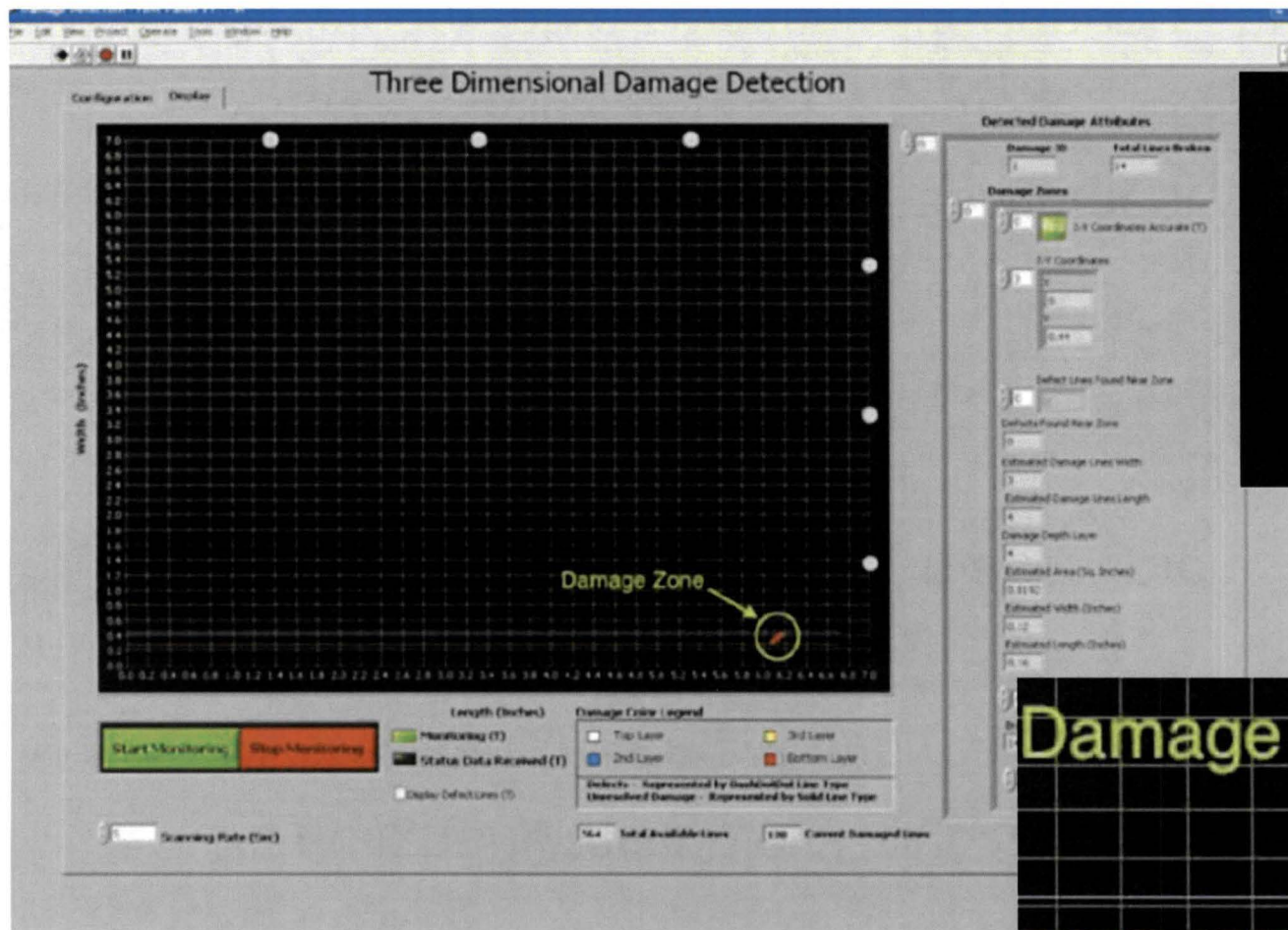
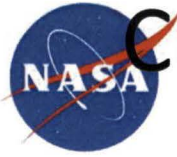


Figure 3 – FSDDS Damage Zone from Desert Rats Testing



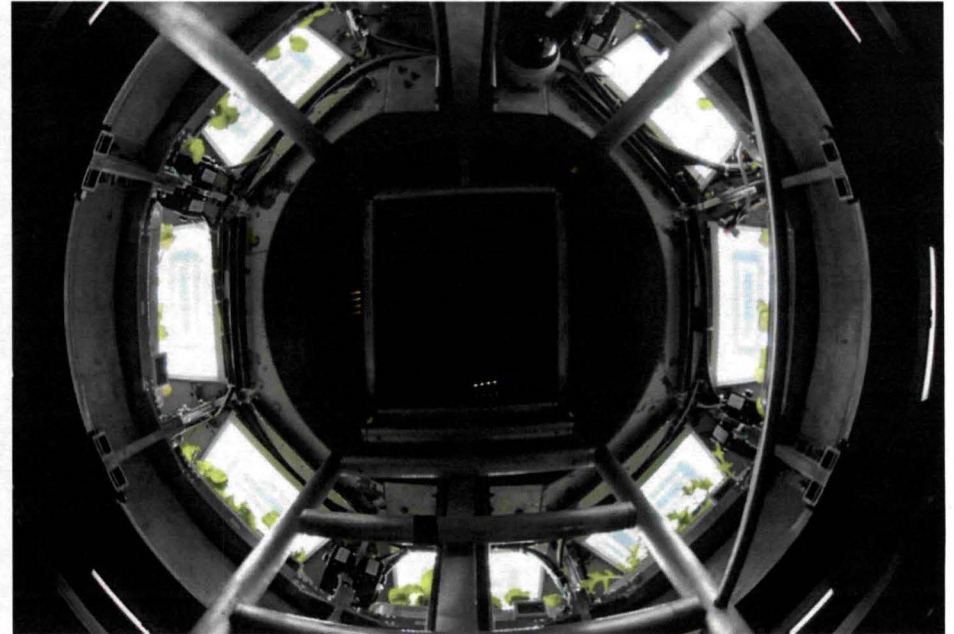
Current Areas of Life Science Research and Technology at KSC

- Plant lighting technology for controlled environment agriculture
- Wastewater treatment and recycling
- Solid waste management
- Microbial risk assessment / management
- Air trace contaminant control
- Life science payload experiments
- Astrobiology (Univ. of Florida IFAS)
- Ecosystems research and management
- Medical device testing for remote medical monitoring
- Development of cryogenic life support apparatus



Food Production

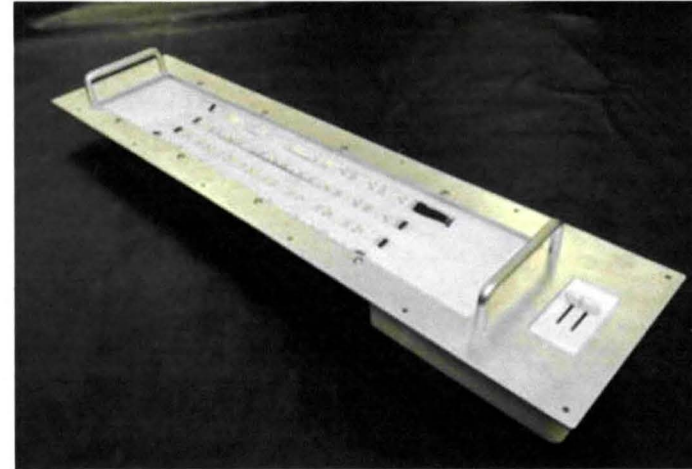
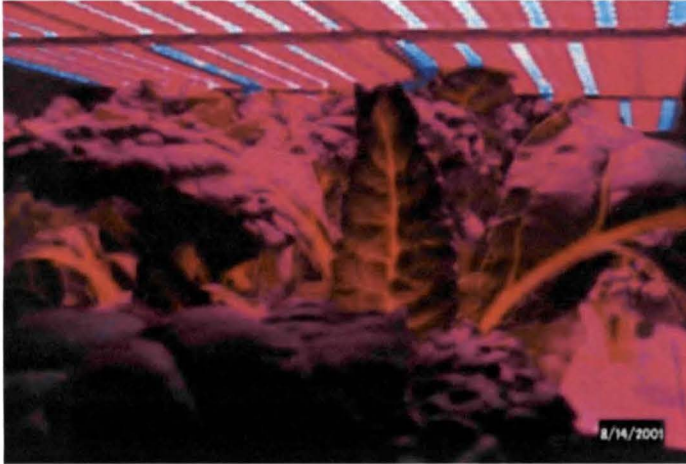
Deep Space Hab Atrium in the Habitat Demonstration Unit



Showed how under-utilized space in a Hab could be used for plant growth to supplement diet, add psychological benefit, and assist environmental systems

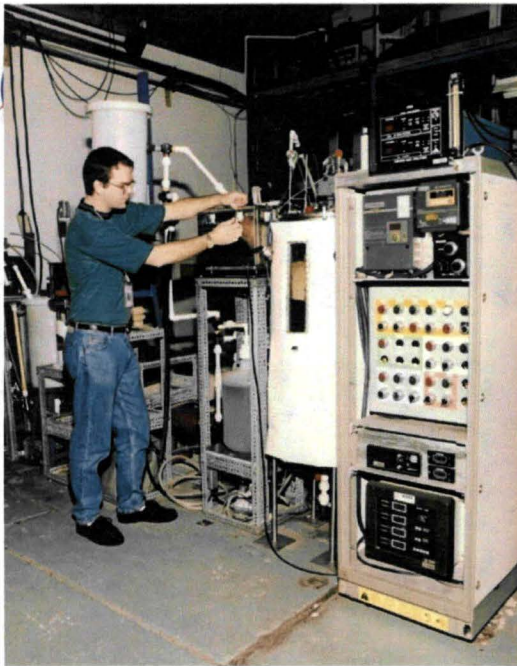


LED Lighting

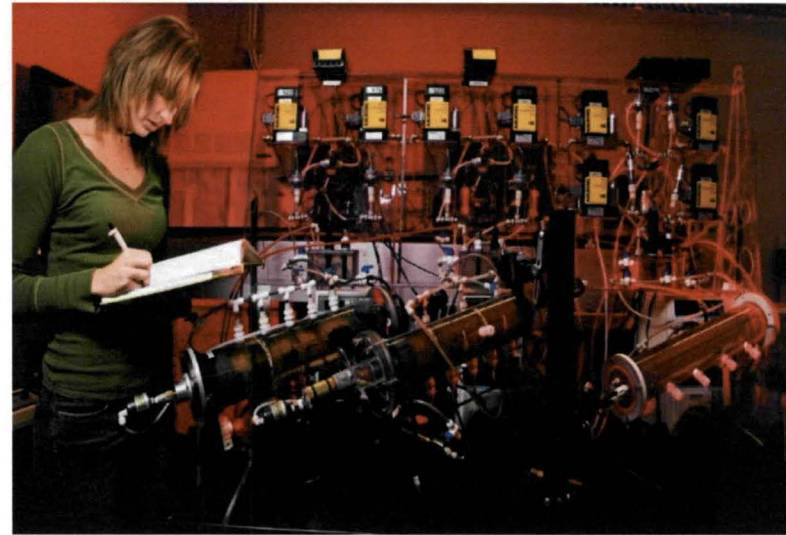


Developed pathfinding efforts in solid state lighting tailored for plant growth and developing a system to assist in circadian adaptation for crew to assist in proper sleep cycles and adjustment to variable work shifts

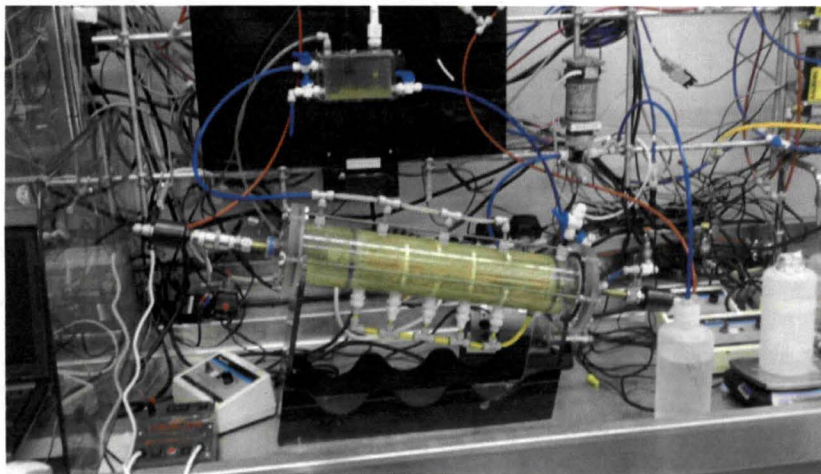
Wastewater / Solid Waste Treatment



Solid Waste Stirred Tank Reactors



Graywater and Septic Effluent Treatment



Urine Hydrolysis and Nitrification

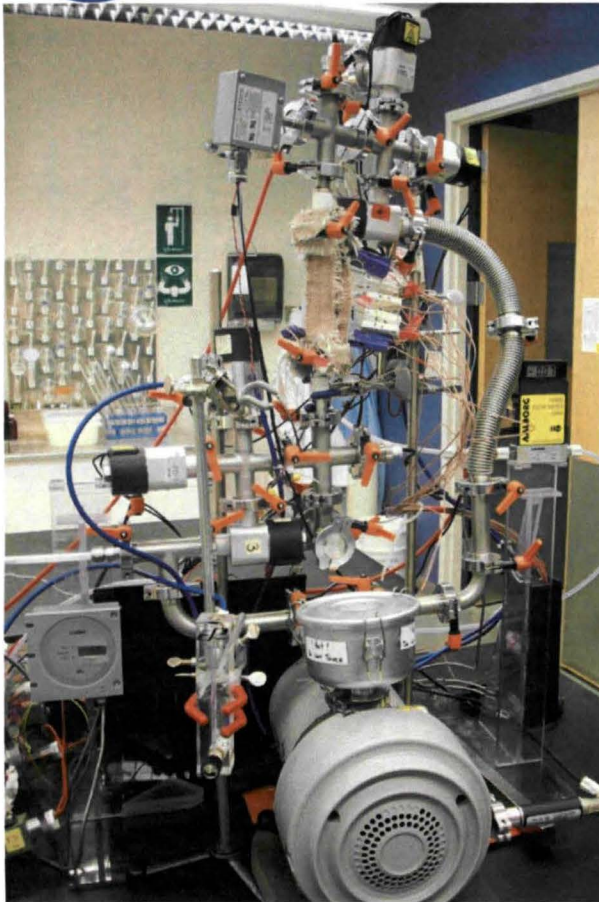


Solid Waste / Aquaculture Systems

Mackowiak et al. 1996. Acta Hort; Garland et al. 1997. Adv. Space Res.; Morales et al. 1996. FEMS Microb. Ecol. 20:155-162.

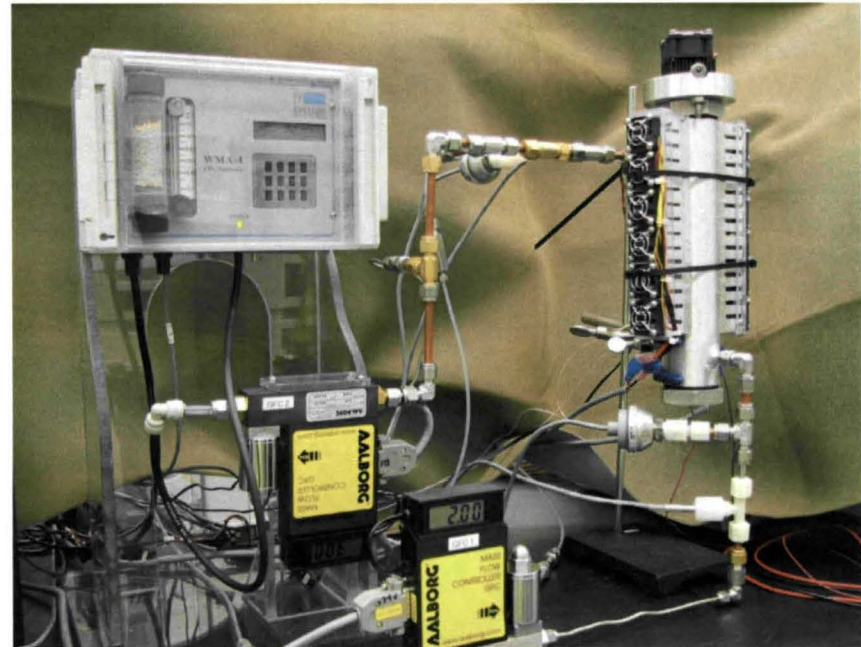


Air Trace Contaminant Control

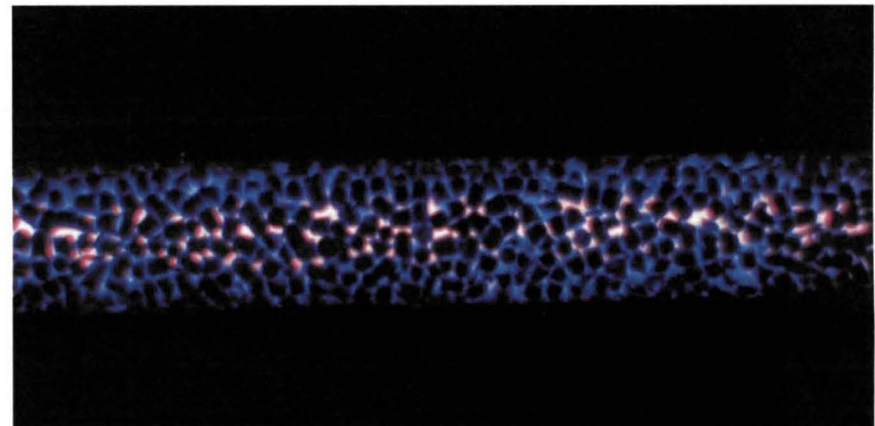


Test Bed for Regenerable Sorbents

Titania Pellets
Surrounding
UV Lamp (PCO)



Photocatalytic Oxidation (PCO) Test Stand





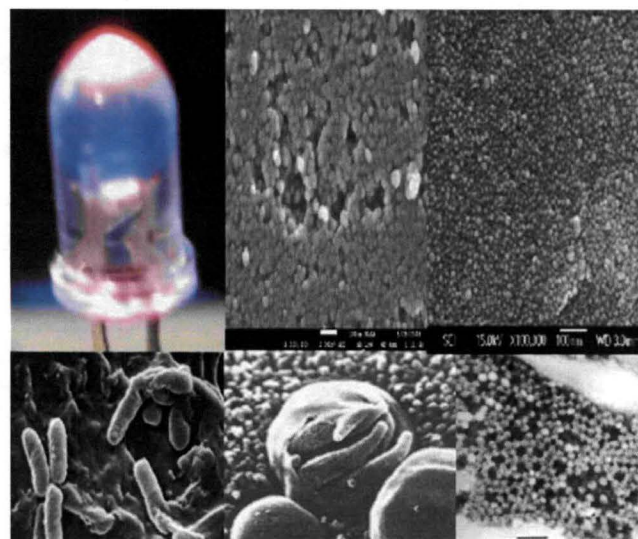
Microbial Risk Assessment



Lada Plant Chamber on Intl Space Station (ISS) and Food Safety



Solid Waste Retrieved from ISS



UV Radiation and Antimicrobial Materials for Potable Water

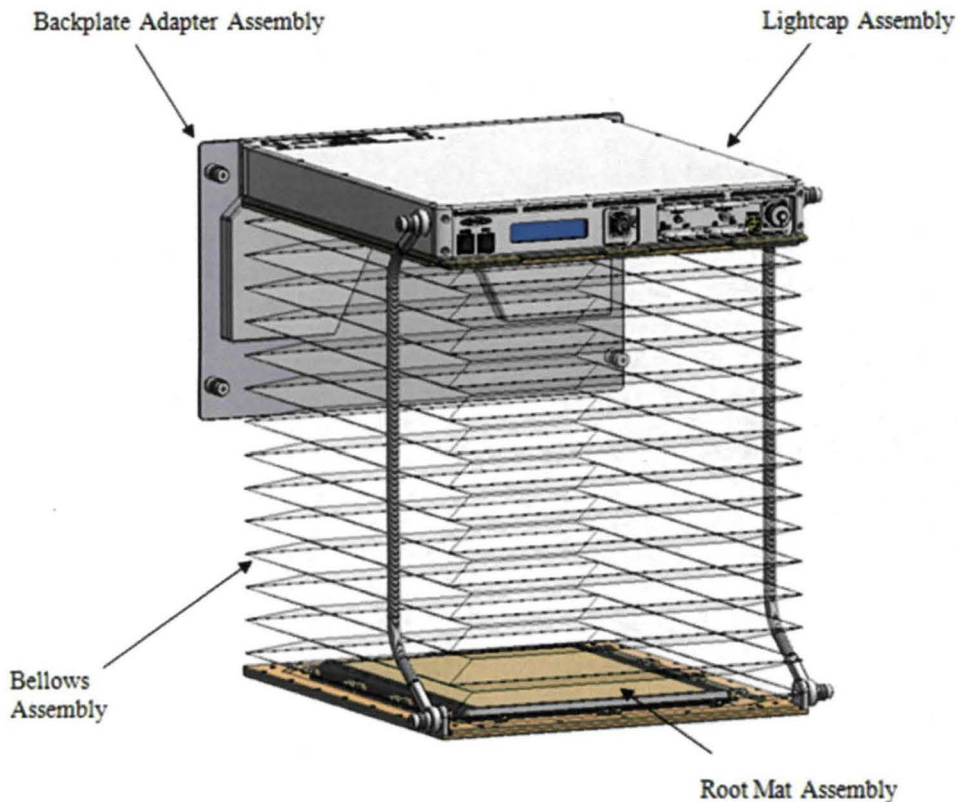


Related ISS Payload Development



Food Production Units

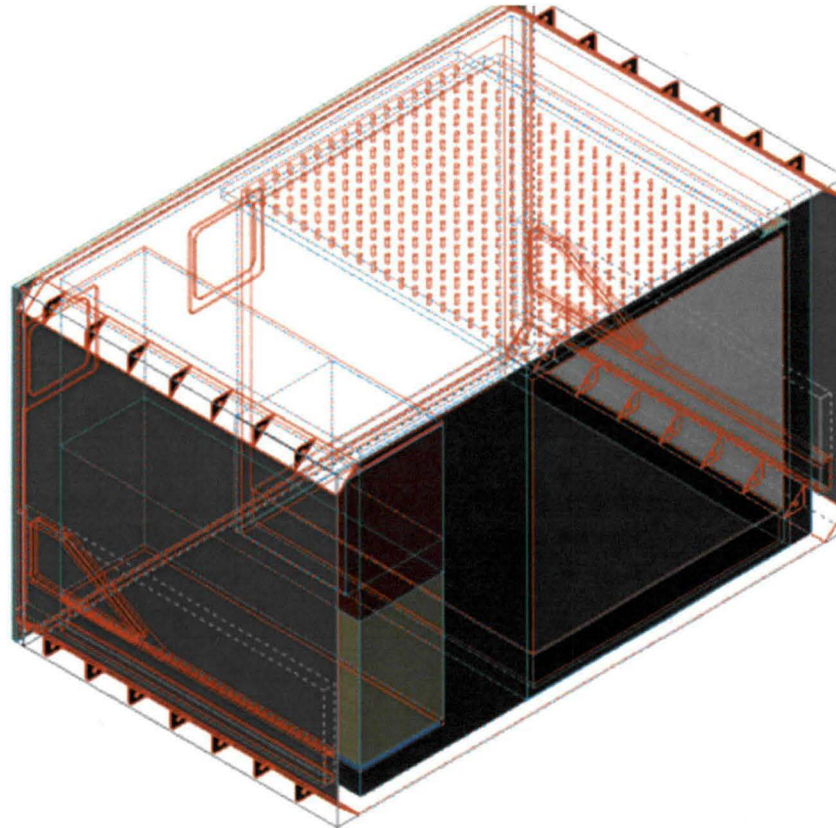
VEGGIE



This is a KSC developed flight payload being prepared for the ISS. The concept is to demonstrate plant growth to supplement the crew's diet with fresh, perishable foods and herbs while on exploration campaigns.



Food Production Units Advanced Plant Habitat



- Quad-locker ISS EXPRESS rack payload under design for growing plants.
- Environmental control of humidity, temperature, lighting, CO₂, and ethylene
- Intended to be a plant growth facility for scientific customers to develop experiments.



Questions?

Contact Information:

- Tracy R. Gill - NASA/KSC
Research and Technology Management Office
Mail Code AD-T, KSC, FL 32899
Phone 321-867-5824
Tracy.R.Gill@nasa.gov
- Eirik Holbert, PhD
Electrostatics and Surface Physics
Mail Code NE-S, KSC, FL 32899
Phone 321-867-6984
Eirik.Holbert-1@ksc.nasa.gov



Backup Info

DRaTS HDU-DSH Configuration



Ruggedized A/C Unit
(not shown)

Power Interface Cart
(not shown)

Dust Mitigation Module
(FY10)

Hab Functions:

Univ of Wisconsin's Inflatable Loft

<http://www.spacegrant.org/xhab/>

Hygiene Function / Module

- Toilet
- Hand Wash
- Whole Body Wash

Lab Functions

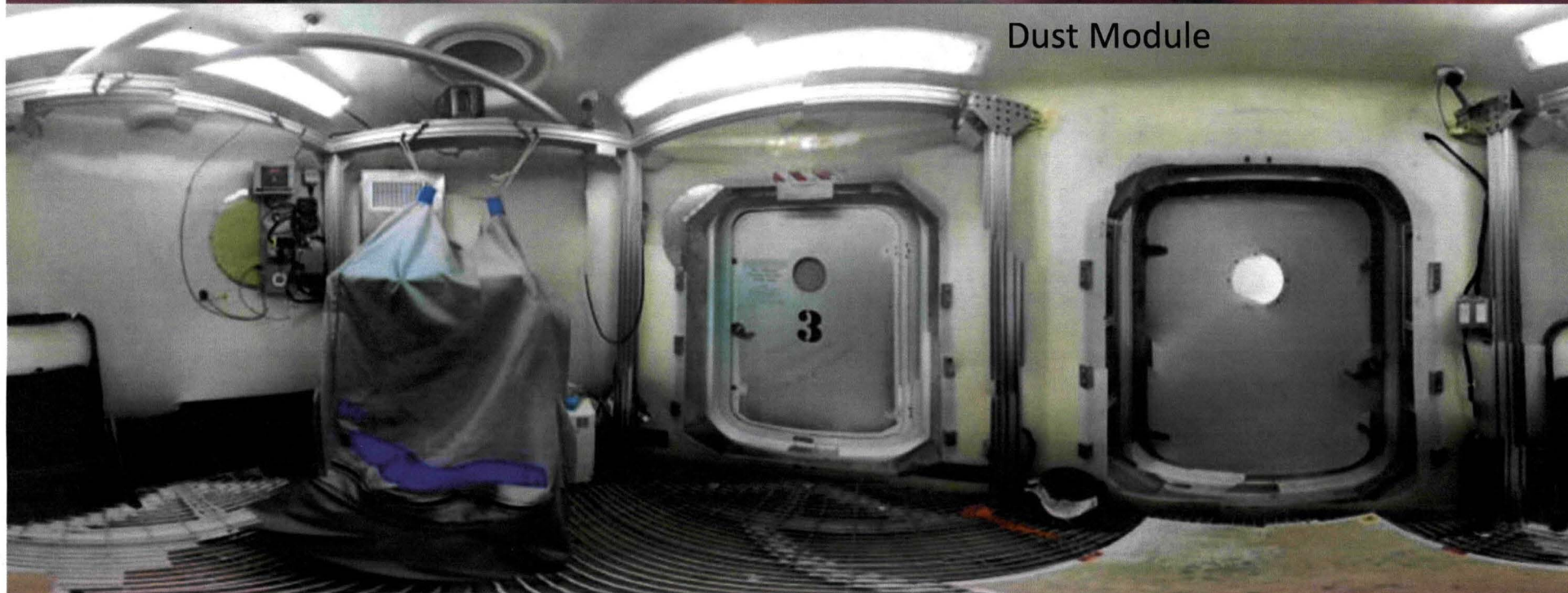
GeoLab, Telerobotics W/S, Med Ops,
EVA/ Gen Maint. W/S

NASA built, assembled, and outfitted a 4-
port 1-story vertical Lab in FY10

Deployable Porch
and Ramp



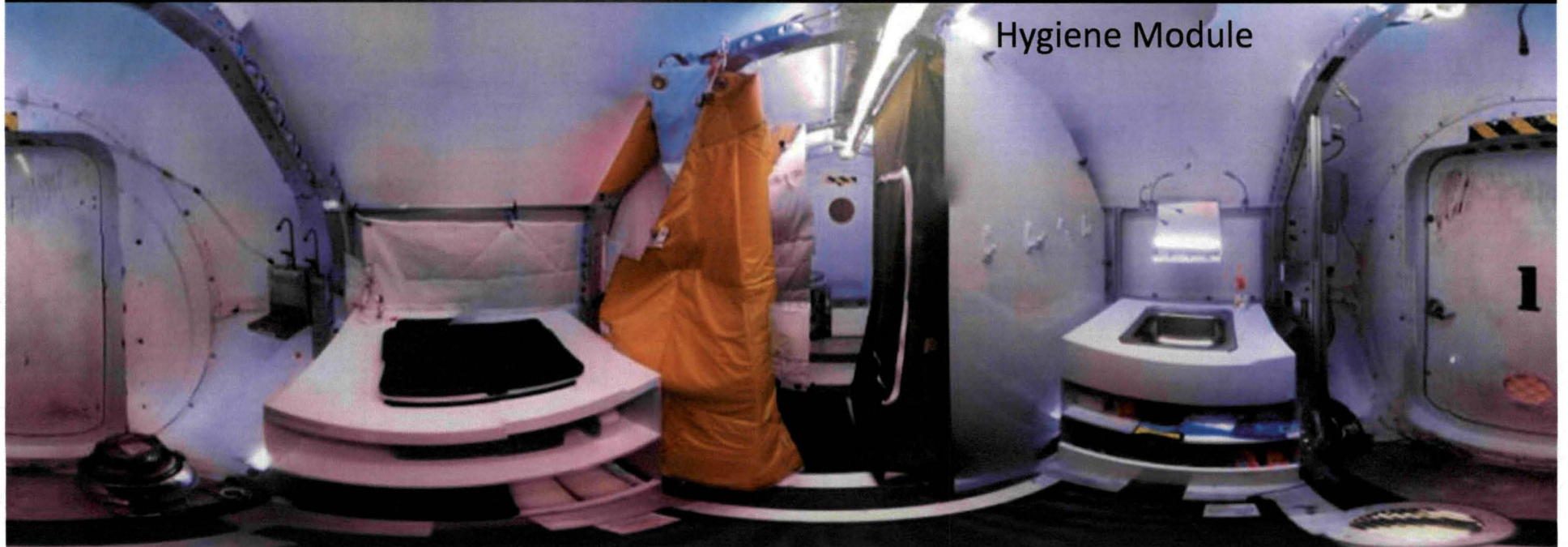
HDU Lab deck



Dust Module



X-Hab Inflatable Loft

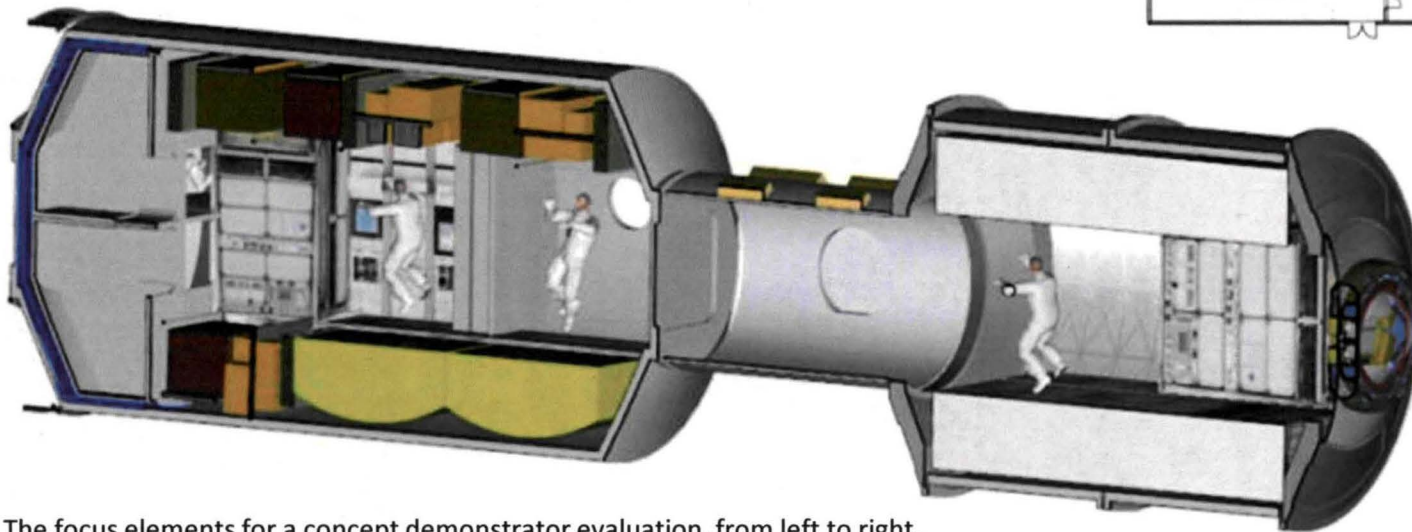
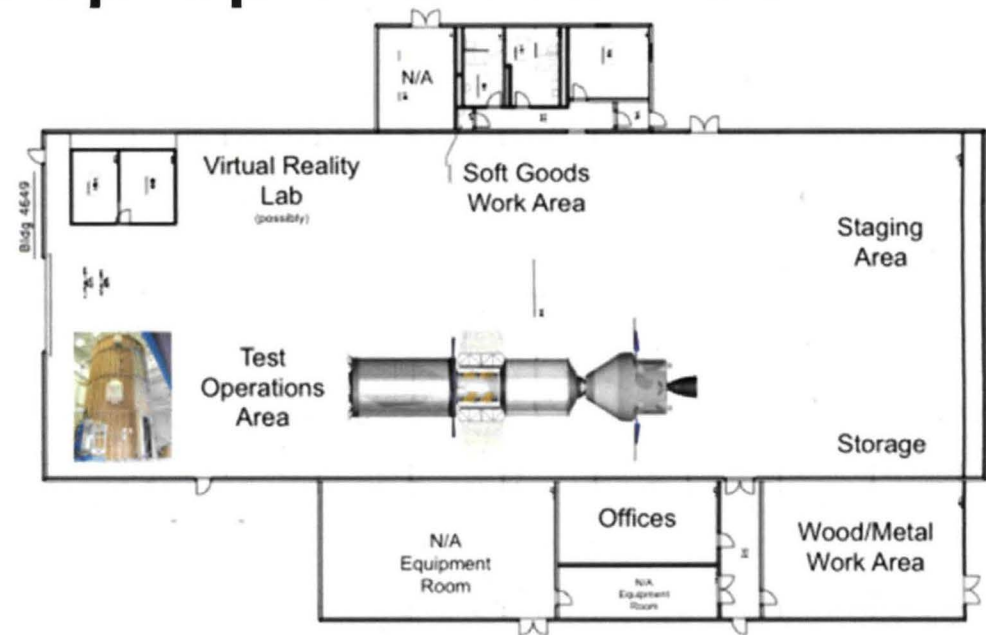


Hygiene Module



ISS-derived Deep Space Habitat

- The team is retiring the HDU at JSC.
- At MSFC, adding a new concept demonstrator DSH based on ISS elements being developed by our multi-center team.



The focus elements for a concept demonstrator evaluation, from left to right, Hab, tunnel, and MPLM configured as a Deep Space Habitat



Deep Space Habitat Demonstrator Evolution

ISS-derived Deep Space Habitat concept demonstrator at MSFC coming together in Building 4649, adding MPLM (right), a Node module (below), and a tunnel

